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CANADA

FEATURE

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BACTERIA CAN BEAT BUGS

by ANIL AGRAWAL

A bacterium that was discovered by chance on dead mosquito larvae in an Israeli pond about three years ago is today the cause of considerable excitement in the Geneva-based World Health Organization. The bacterium can kill disease-carrying insects like blackflies, which spread the dread disease of river blindness in West Africa, and mosquitoes which spread malaria.

Growing resistance amongst mosquitoes has forced WHO to scale down its anti-malaria operations and look for techniques to control the vectors of disease (disease-carrying insects) other than using chemical insecticides. Since the beginning of its special programme for research in tropical diseases, WHO has concentrated most of its research efforts in the area of vector control on biological control techniques.

Industrial and scientific interest in this new bacterium, officially known as Bacillus thuringiensis israelensis (B.t.i.), has virtually exploded since its discovery in 1977 by a team of one Israeli and one American scientist. Research conducted on the bacterium by Dr Huguette de Barjac at the Pasteur Institute shows that it kills some very specific insects and is, therefore, safe to man and to a range of non-target organisms like bees, vertebrates and other mammals.

According to Dr Jacques Hamon, director of WHO's vector biology and control division, B.t.i. should be approved for use by environmental regulatory authorities of developed countries like USA, Canada and France very soon. Leading Western pesticide manufacturers are already taking an active interest in manufacturing B.t.i.

There is considerable scope for further scientific research on the new bacterium. Why B.t.i. kills certain specific insects is still not fully understood, except that it paralyses the digestive system of the larvae when

they ingest it. The molecule responsible for the toxic activity has still not been identified. Using genetic engineering techniques, it may be possible to produce new strains of the bacterium that produce more of this poisonous substance.

An important question for developing countries, however, is: will they be able to produce this new bacterial insecticide themselves? Broadly speaking any country with experience in brewing should be able to produce bacterial insecticides, it could even become a cottage industry. Bacterial insecticides would then become even more attractive to developing countries than chemical insecticides, which have to be imported at considerable cost in precious foreign exchange.

Theoretically, cottage-scale production of bacterial insecticides should be possible with some support from a central facility that helps to maintain quality and regularly supplies uncontaminated seeds for cultures. But Dr Jacques Hamon, who is now planning to study how developing countries can be helped to produce bacterial insecticides on a cottage scale, believes several problems will have to be solved first. Bacillus thuringiensis is, in fact, not a new bacterium. Several strains of B.t. have already been used extensively in the USA, Europe and China against agricultural and forest pests. China is reported to have used over 1000 tonnes of B.t. in agricultural operations, and has had considerable experience in cottage-side production of bacterial insecticides.

For producing B.t. the Chinese extensively use a simple semi-solid medium: a mixture of wheat bran and corn meal, or sometimes soya bean and cotton seed cake. Pure cultures of B.t. are kept at provincial institutes and distributed to county and commune units for local growth using locally available materials. This crude system of production has helped to reduce transport needs and production costs but it has had to contend with contamination of the culture with phages -- bacteria eating organisms.

Apart from solving this problem of phage contamination, technologists will also have to find special ways to formulate B.t.i. before it can used most effectively in the field. B.t.i. is heavier than water and, therefore, will sink to the bottom of a pond or river while the larvae of mosquitoes and blackflies are found near the surface. Formulation technology is complex and is usually kept secret by pesticide companies. WHO has approached the UN Industrial Development Organisation in Vienna and the UN Environment Programme in Nairobi to explore ways for cottage-scale production of B.t.i. WHO also needs to do more to involve prospective manufacturers in the developing countries.

Production of bacterial insecticides may become an important area for technical cooperation among developing countries. China is now experimenting keenly with B.t.i. and with its past experience in cottage-scale production may be able to find a viable alternative production strategy. India, too, is now taking an interest in bacterial insecticides. Its Vector Control Research Centre in Pondicherry is one of the best biological control research institutions in the developing world. Says Dr Hamon: "These two countries should certainly be able to solve all the problems."

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